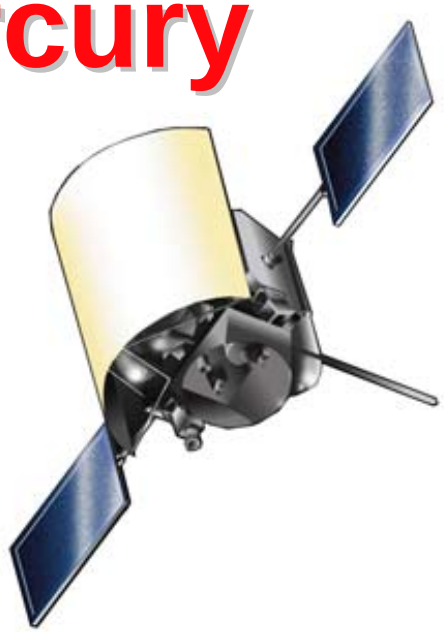
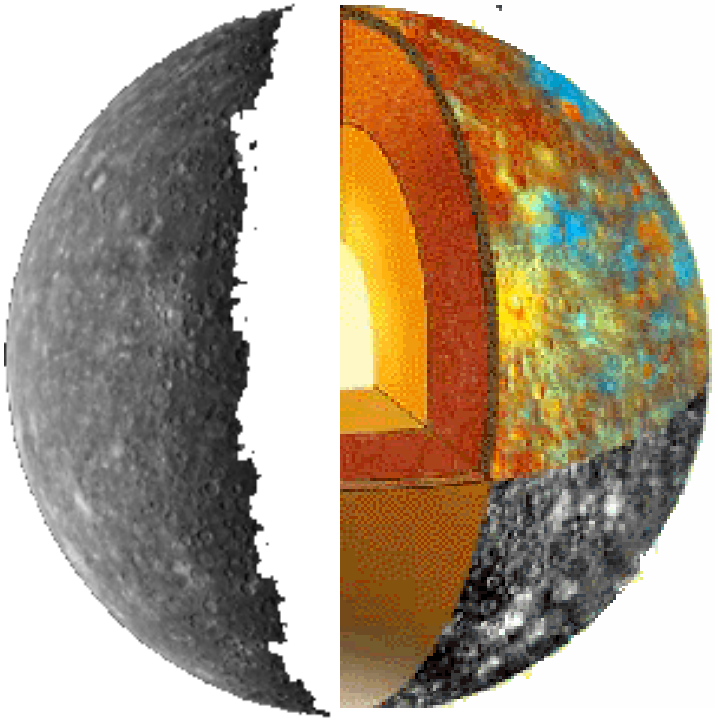
MESSENGER

Exploring Mercury





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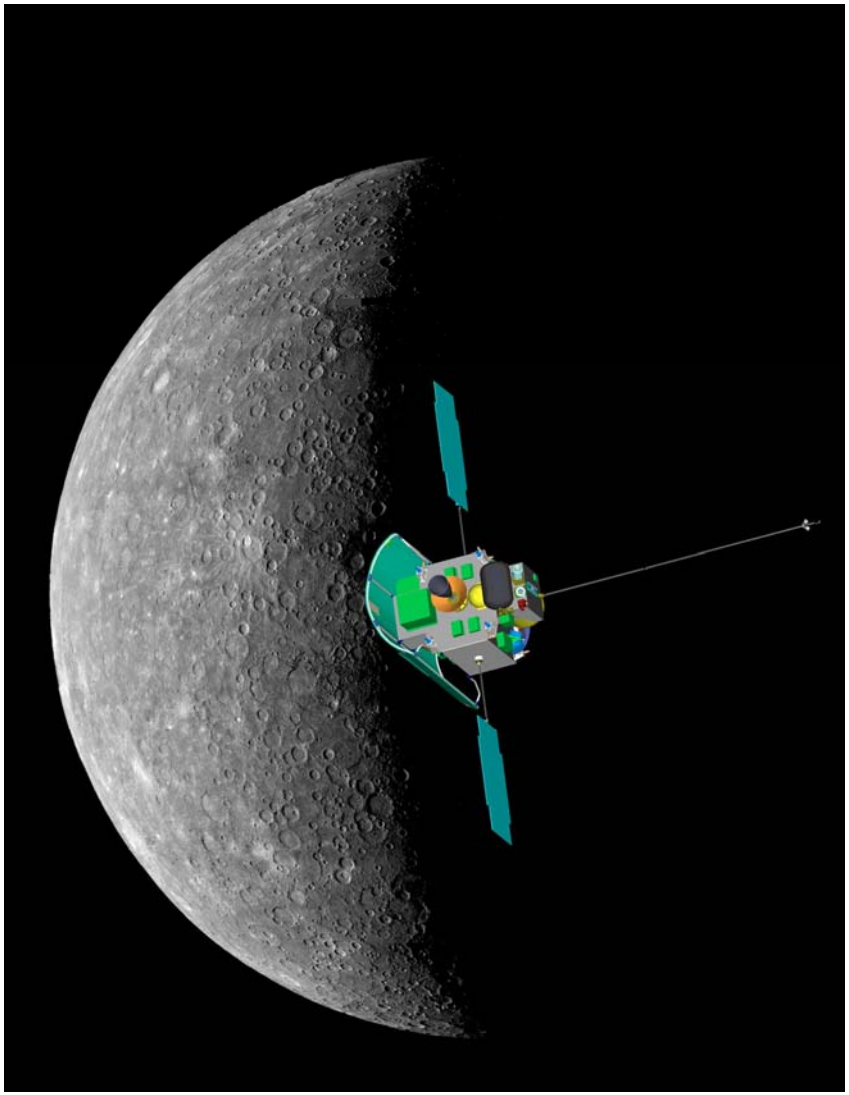


MESSENGER

Mercury:

Surface

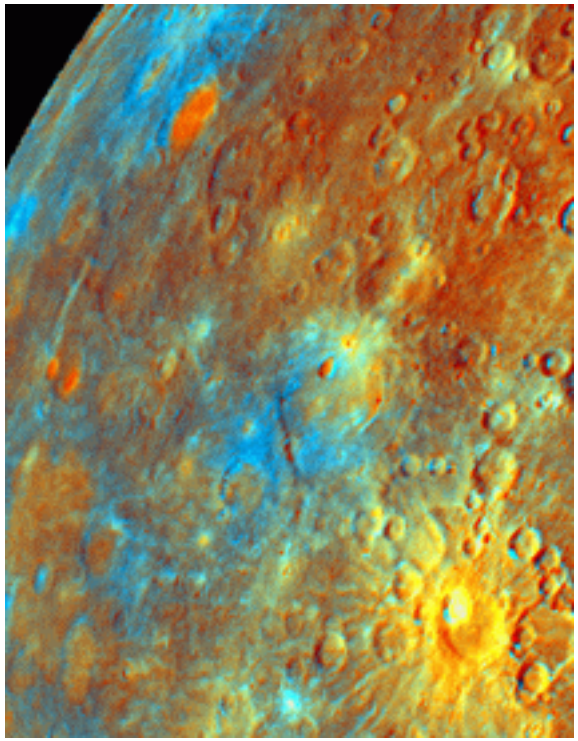
Space ENvironment

GEochemistry and

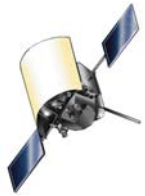
Ranging

MESSENGER

The Mission



MESSENGER is a scientific investigation of the planet Mercury. Understanding Mercury, and the forces that have shaped it, is fundamental to understanding the terrestrial planets and their evolution.



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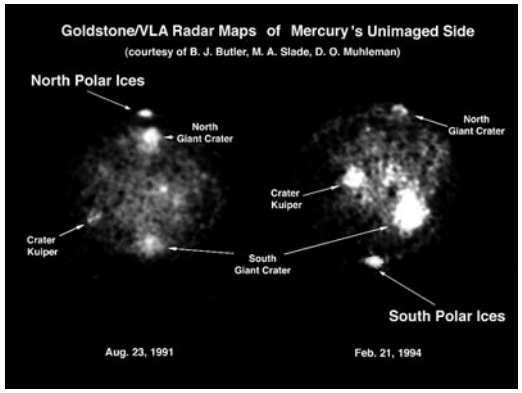
Key Science Questions

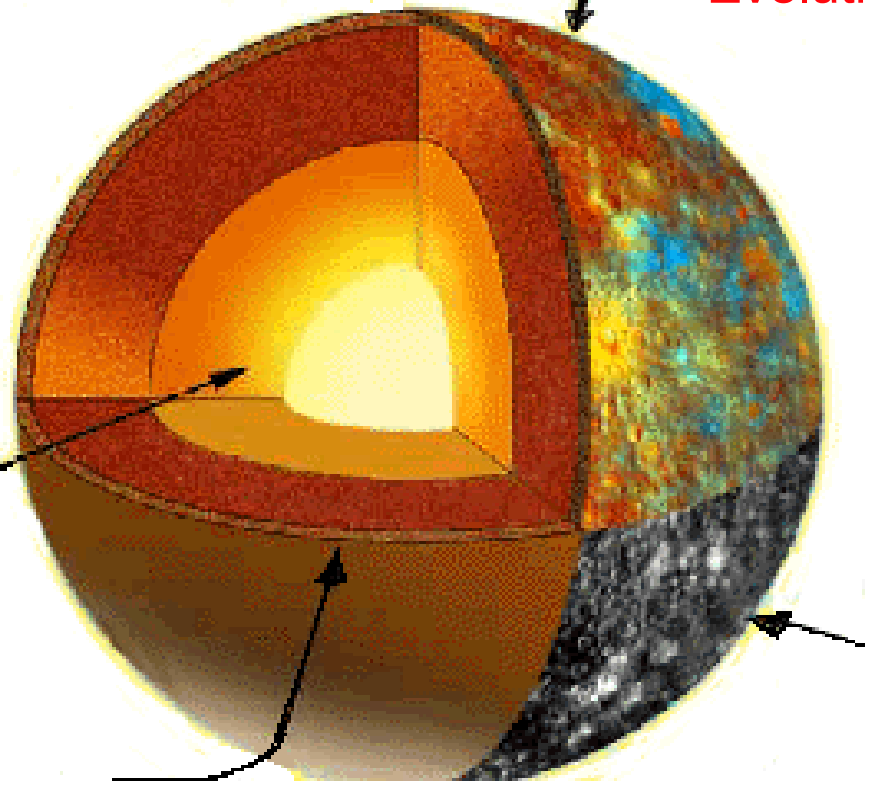
- Why is Mercury so dense?
- What is the geologic history of Mercury?
- What is the structure of Mercury's core?
- What is the nature of Mercury's magnetic field?
- What are the unusual materials at Mercury's poles?
- What volatiles are important at Mercury?

MESSENGER
Science

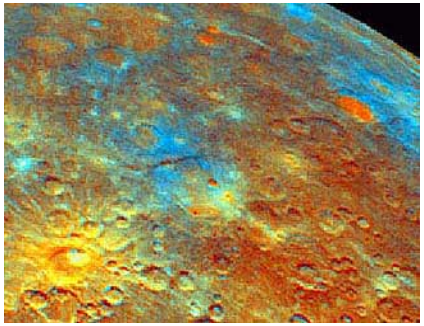
Polar Cap Volatiles

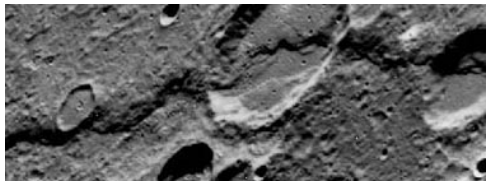


Crustal Evolution



Core and Magnetic Dynamo



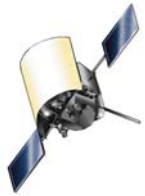


Geologic Evolution

Crust and Mantle

Magnetosphere

Exosphere



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Science Payload

- **Mercury Dual Imaging System (MDIS)**

  Narrow-angle imager and wide-angle multispectral imager. Maps landforms, surface spectral variations, and topographic relief from stereo imaging.

- **Gamma-Ray and Neutron Spectrometer (GRNS)**

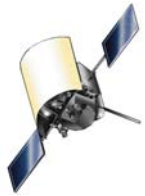
  Gamma-ray mode measures the emissions from radioactive elements and gamma-ray fluorescence stimulated by cosmic rays. Used to map elemental abundances in crustal materials. Neutron mode provides sensitivity to map hydrogen in ices at the poles.

- **Magnetometer (MAG)**

  Maps out the detailed structure and dynamics of Mercury's magnetic field and searches for regions of magnetized crustal rocks.

- **Mercury Laser Altimeter (MLA)**

  An infrared laser transmitter coupled with a receiver that measures the round-trip time of a burst of laser light reflected off Mercury's surface, yielding a distance measurement. Produces highly accurate measurements of topography, and measures Mercury's slight wobble due to the planet's libration.



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Science Payload

- **Atmospheric and Surface Composition Spectrometer (ASCS)**

  Ultraviolet-visible spectrometer measures abundances of atmospheric gases. Visible-infrared spectrometer detects minerals in surface materials.

- **Energetic Particle and Plasma Spectrometer (EPPS)**

  Measures the composition, spatial distribution, energy, and time-variability of charged particles within and surrounding Mercury's magnetosphere.

- **X-Ray Spectrometer (XRS)**

  Measures the fluorescence in low-energy X-rays that is stimulated by solar gamma rays and high-energy X-rays. Used to map elemental abundances in crustal materials.

- **Radio Science (RS) uses telecommunication system**

  Uses the Doppler effect (the shift in the frequency of the spacecraft's radio signal with changes in the spacecraft's velocity relative to Earth) to measure Mercury's mass distribution, including spatial differences in crustal thickness.

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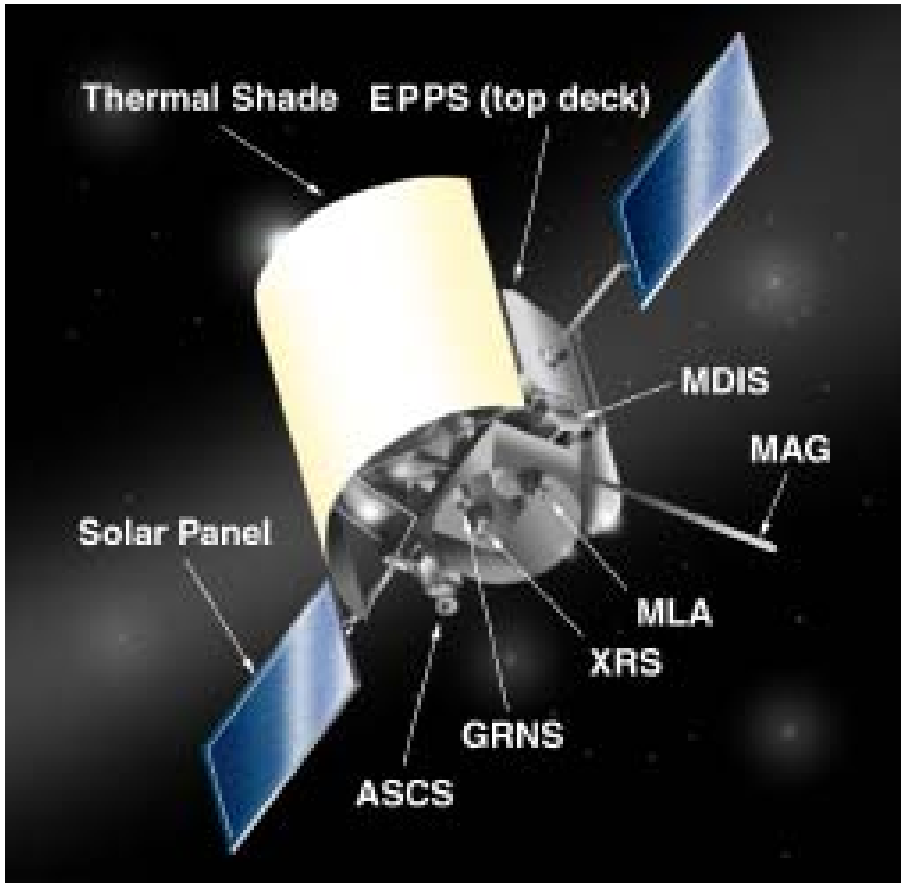
Space Craft Design



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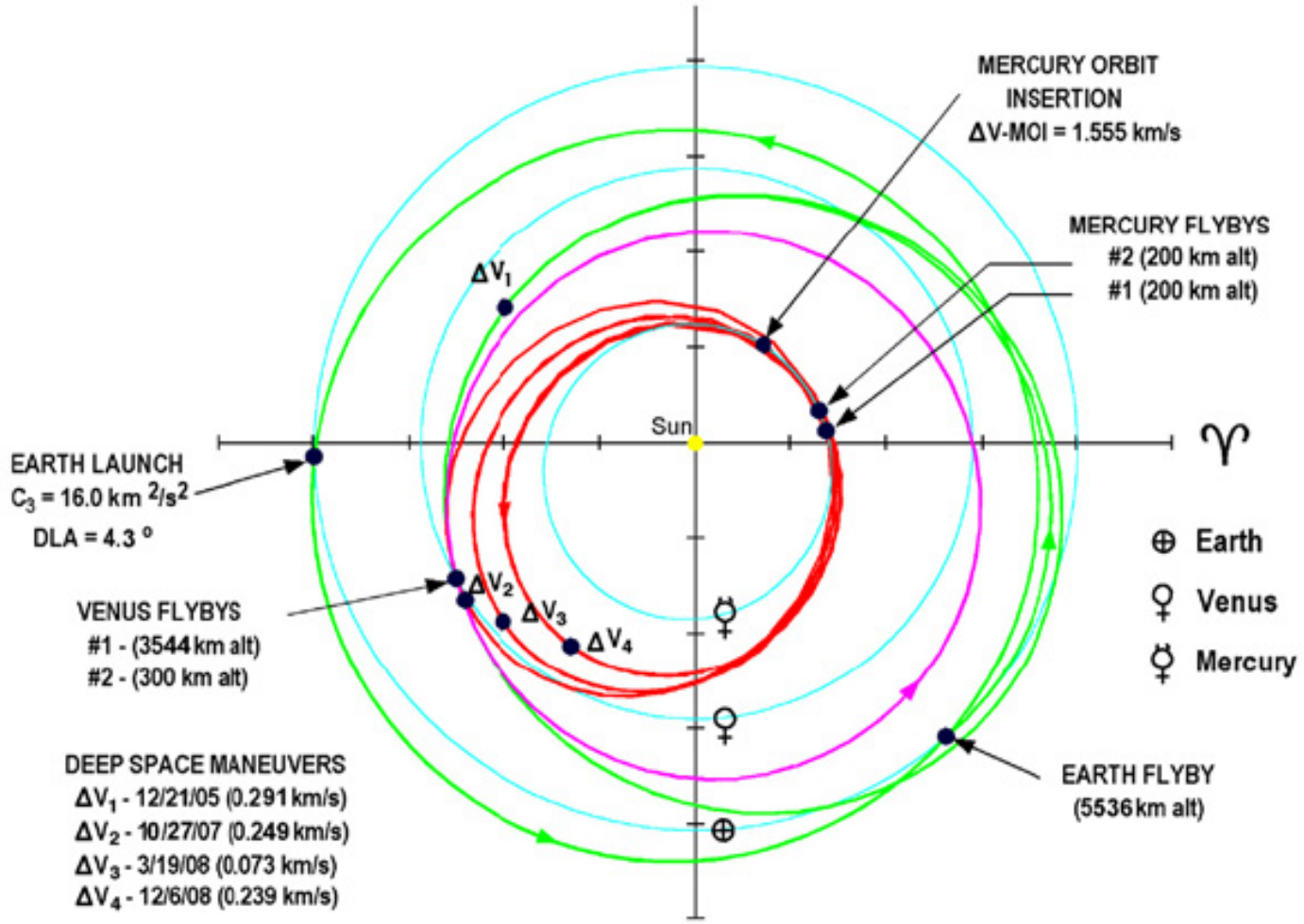
Mission Design



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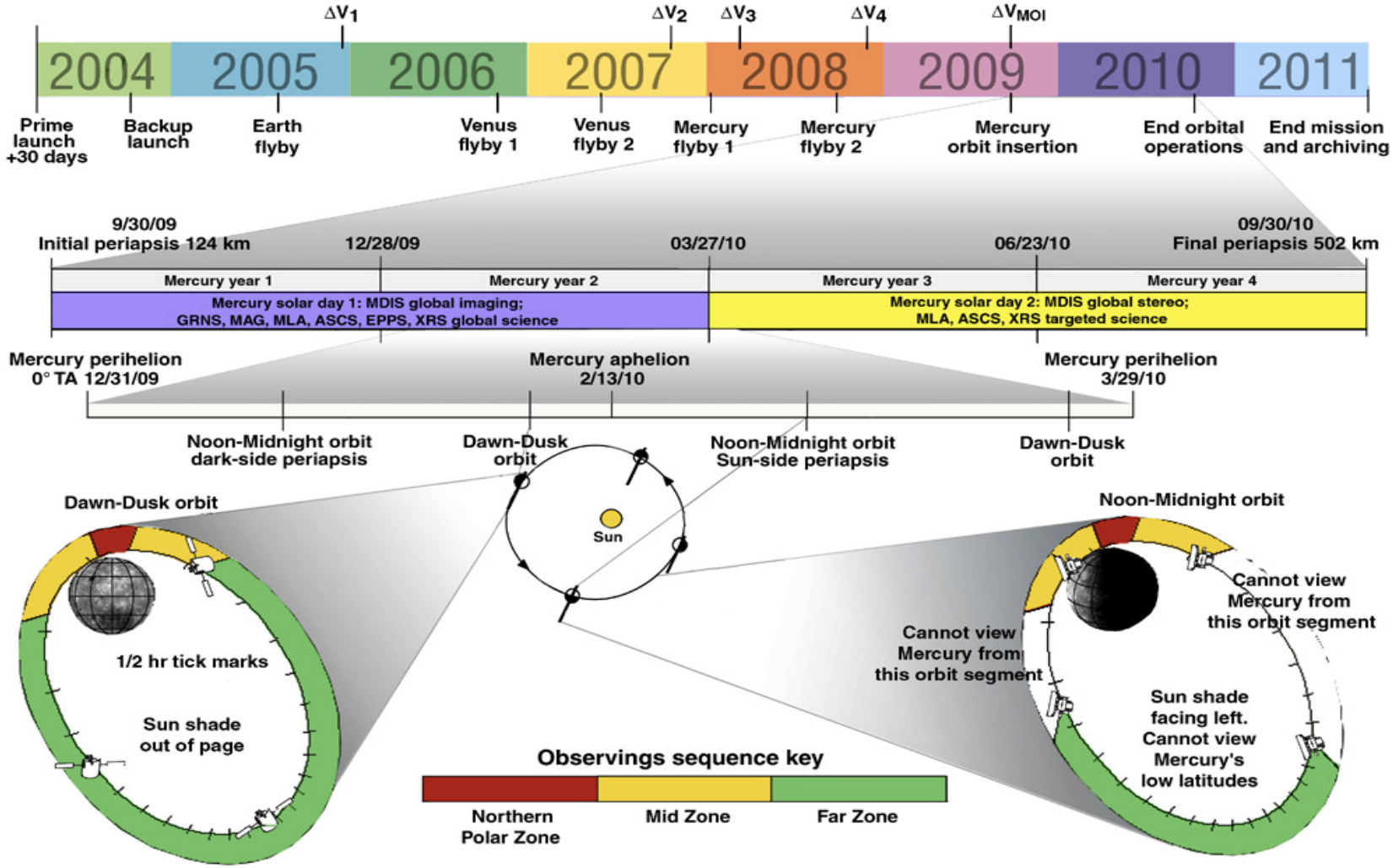
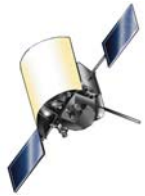
Timeline Shows Mission Implementation



Alternate 12-hour orbits used for downlink
Limited observations during 8 hours farthest from Mercury

99-0560



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Education Goals

- **Reflect NASA's evolving E/PO visions and goals**
- **Utilize qualified, knowledgeable professionals at all stages**
- **Align with national educational standards and reform initiatives**
- **Develop programs and activities accessible to all levels of age, education, and privilege**
- **Strengthen working partnerships with capable groups to maximize quality and reach.**

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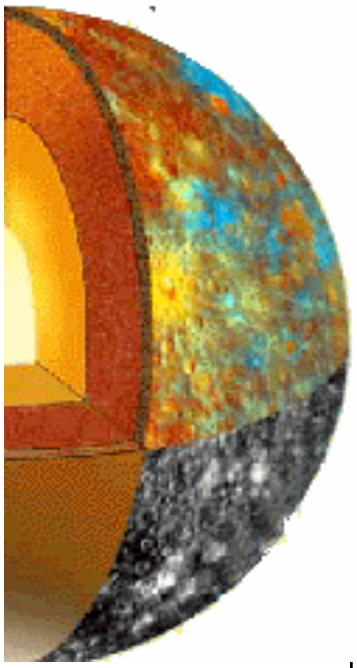
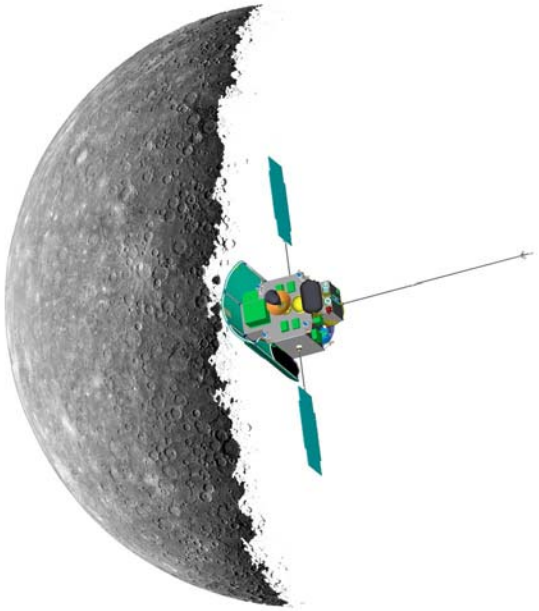
Education Activities

- **MESSENGER Guide for Educators**
  - Create engineer/scientist-teacher teams
  - Identify relevant content and associated skills
  - Map to education standards
- **MESSENGER Classroom**
  - Develop and incorporate education models into existing programs
  - Link classrooms to real data
  - Includes opportunities for internships for students, preservice and inservice teachers



- **MESSENGER Educator**
  - K-12 teachers and teacher trainers
    - Emphasize teacher training as a method of dissemination
    - Regional workshops for educators
    - Train-the-trainer workshops
    - Teacher internships
  - On-line audiences
    - Expand MESSENGER web site
    - Establish links with multiple partners
    - Adapt materials for web site delivery
    - Incorporate into on-line teacher training courses



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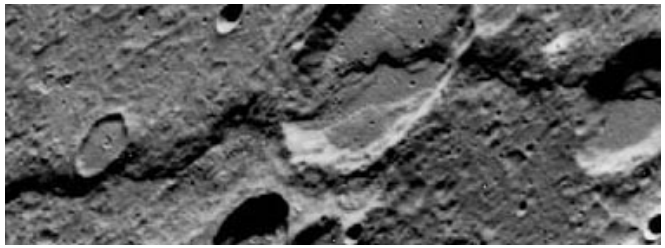
Public Outreach

- **Eye of MESSENGER**
  - Develop Mercury observation campaign
- **MESSENGER Extended Family**
  - Incorporate MESSENGER education modules into Windows on the Universe
  - Provide speakers for MU-SPIN NRTS workshops
- **MESSENGER The Movie**
  - Develop proposal for MESSENGER documentary
  - Secure broadcasting partners
  - Develop a documentary series chronicling the mission



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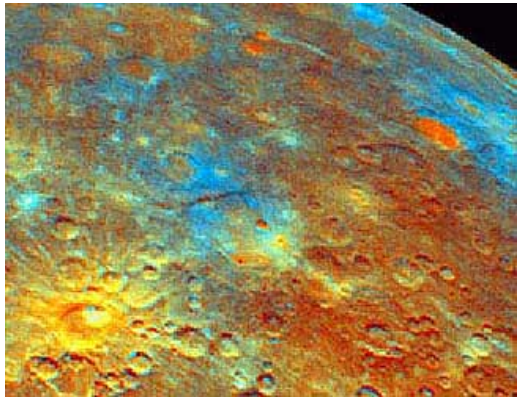
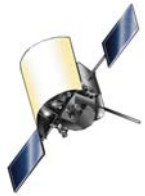
Public Outreach

- **Voice of MESSENGER**
  - Provide media training for science team
  - Prepare articles for publication
  - Develop radio segments
- **MESSENGER Broadside**
  - Evolve museum exhibits to include computer feeds with spacecraft status and “real time” science data
  - Develop “plain language book” targeted at disadvantaged community outreach





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Education and Public Outreach Team

- **MST** - Messenger Science Team members
- **AAAS** - American Association for the Advancement of Science
- **CCSSE** - Challenger Center for Space Science Education
- **SSAI** - Science Systems and Applications, Inc
- **CASE** - Carnegie Academy for Science Education
- **JHU/APL** - The Johns Hopkins University Applied Physics Laboratory
- **GSFC** - Goddard Space Flight Center
- **MU-SPIN** - Minority University-Space Interdisciplinary Network
- **CERES** - Center for Educational Resources at Montana State University
- **SEI** - Space Explorers Inc.
- **NASM** - National Air and Space Museum
- **AMNH** - American Museum of Natural History in New York
- **PW** - Parmee/Weinrich independent television production/direction team

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Come and Explore Mercury with us!